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SIST EN 3973:2009

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
EUROPÄISCHE NORM

**EN 3973**

December 2006

ICS 49.025.10

English Version

**Aerospace series - Steel FE-CM3801 (X5CrNiCuNb16-4) -  
Homogenized, solution treated and precipitation hardened -  
Investment casting -  $De \leq 50$  mm -  $Rm \geq 1\ 030$  MPa**

Série aérospatiale - Acier FE-CM3801 (X5CrNiCuNb16-4) -  
Homogénéisé, mis en solution et durci par précipitation -  
Pièces moulées en cire perdue -  $De \leq 50$  mm -  $Rm \geq 1\ 030$   
MPa

Luft- und Raumfahrt - Stahl FE-CM3801 (X5CrNiCuNb16-4)  
- Homogenisiert, lösungsgeglüht und ausgelagert -  
Feingußstücke durch Wachsausschmelzverfahren -  $De \leq$   
50 mm -  $Rm \geq 1\ 030$  MPa

This European Standard was approved by CEN on 18 October 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

**Management Centre: rue de Stassart, 36 B-1050 Brussels**

## Foreword

This document (EN 3973:2006) has been prepared by the Aerospace and Defence Industries Association of Europe - Standardization (ASD-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of ASD, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by **June 2007**, and conflicting national standards shall be withdrawn at the latest by **June 2007**.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

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## Introduction

This standard is part of the series of EN metallic material standards for aerospace applications. The general organization of this series is described in EN 4258.

This standard has been prepared in accordance with EN 4500-5.

## 1 Scope

This standard specifies the requirements relating to:

Steel FE-CM3801 (X5CrNiCuNb16-4)  
Homogenized, solution treated and precipitation hardened  
Investment casting  
 $D_e \leq 50$  mm  
 $R_m \geq 1\ 030$  MPa

for aerospace applications.

## 2 Normative references

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The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (*including any amendments*) applies.

EN 2103-3, *Aerospace series — Steel, nickel base and cobalt base alloy remelting stock and castings — Technical specification — Part 3 — Pre-production and production castings.*

EN 3484, *Aerospace series — Steel FE-CM61 — As cast — Reference heat treatment: homogenised, solution treated, precipitation hardened and sub zero — Remelting stock.* <sup>1)</sup>

EN 4258, *Aerospace series — Metallic materials — General organization of standardization — Links between types of EN standards and their use.*

EN 4436, *Aerospace series — Steel — Test methods — Determination of  $\delta$  ferrite content.* <sup>1)</sup>

EN 4500-5, *Aerospace series — Metallic materials — Rules for drafting and presentation of material standards — Part 5: Specific rules for steels.* <sup>1)</sup>

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1) Published as ASD Prestandard at the date of publication of this standard.

## EN 3973:2006 (E)

1	Material designation		Steel FE-CM3801 (X5CrNiCuNb16-4)										
2	Chemical composition %	Element	C	Si	Mn	P	S	Cr	Ni	Cu	N <sub>2</sub>	Nb+Ta	Fe
		min.	–	0,50	–	–	–	15,5	3,60	2,80	–	0,15	Base
		max.	0,06	1,00	0,70	0,04	0,03	16,7	4,60	3,50	0,05	0,40	
3	Method of melting		Air melted										
4.1	Form		Investment casting										
4.2	Method of production		Cast from remelting stock EN 3484										
4.3	Limit dimension(s)	mm	$D_e \leq 50$										
5	Technical specification		EN 2103-3										

6.1	Delivery condition		Homogenized, solution treated and precipitation hardened										
	Heat treatment		1 150 °C / t = 1h 30 min / AC or OQ + 1 040 °C / t ≥ 30 min / AC or OQ / cool to $\theta \leq 20$ °C + 540 °C / t = 1h 30 min / AC										
6.2	Delivery condition code		U										
7	Use condition		Delivery condition										
	Heat treatment		–										

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Characteristics  
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8.1	Test sample(s)		Specimens cut from the casting					Separately cast							
8.2	Test piece(s)		See EN 2103-3. <a href="https://standards.iteh.ai/catalog/standards/sist/517a9582-3cdc-4237-943d-11d111111111/sist-en-3973-2009">https://standards.iteh.ai/catalog/standards/sist/517a9582-3cdc-4237-943d-11d111111111/sist-en-3973-2009</a>					See EN 2103-3.							
8.3	Heat treatment		Delivery condition					Delivery condition							
9	Dimensions concerned	mm	Wall thickness $\leq 25$ <sup>a</sup>					–							
10	Thickness of cladding on each face	%	–					–							
11	Direction of test piece		–					–							
12	Temperature	$\theta$	°C		Ambient					Ambient					
13	Proof stress	R <sub>p0.2</sub>	MPa		≥ 900					≥ 900					
14	T Strength	R <sub>m</sub>	MPa		≥ 1 030					≥ 1 030					
15	Elongation	A	%		≥ 4					≥ 6					
16	Reduction of area	Z	%		≥ 12					≥ 12					
17	Hardness		≥ 34 HRC												
18	Shear strength	R <sub>c</sub>	MPa		–										
19	Bending	k	–		–										
20	Impact strength		–												
21	Temperature	$\theta$	°C		–										
22	Time		h		–										
23	Stress	$\sigma_a$	MPa		–										
24	Elongation	a	%		–										
25	Rupture stress	$\sigma_R$	MPa		–										
26	Elongation at rupture	A	%		–										
27	Notes (see line 98)		a												

30	Microstructure	1	EN 4436
		2	One per batch
		3	Test piece appended to casting
		5	Delivery condition
		7	$\delta$ -ferrite content $\leq$ 15 %
35	Repair by welding	–	See EN 2103-3.
44	External defects	–	See EN 2103-3.
61	Internal defects	–	See EN 2103-3.
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95	Marking inspection	–	See EN 2103-3.
96	Dimensional inspection	–	See EN 2103-3.
98	Notes	–	<sup>a</sup> For wall thickness > 25 mm, properties to be agreed between manufacturer and purchaser.
99	Typical use	–	–

## EN 3973:2006 (E)

100	-	Product qualification	-	Qualification programme to be agreed between manufacturer and purchaser.
<p data-bbox="464 987 1123 1093" style="text-align: center;"><b>iTeh STANDARD PREVIEW</b> <b>(standards.iteh.ai)</b></p> <p data-bbox="427 1133 1161 1227" style="text-align: center;"><u>SIST EN 3973:2009</u> <a href="https://standards.iteh.ai/catalog/standards/sist/517a9582-3cdc-4237-943d-30aefc7149a0/sist-en-3973-2009">https://standards.iteh.ai/catalog/standards/sist/517a9582-3cdc-4237-943d-30aefc7149a0/sist-en-3973-2009</a></p>				